

display of azure-blue carbonate shows itself, intermixed with quartz, through the surface, and is traceable for upwards of 200 yards, extending an average breadth of about 15 ft. Such were the indications which first led to the investigation of this mineral property, and which have produced such unusual and splendid results.

The following is the total amount of sales of copper ore from the Burra Burra Mine, from the commencement, according to our Swansea Ticketing Papers:

Quarters ended	Sales	Value
Sept. 30, 1846	301	£193 19
Dec. 31, 1846	737	13,777 4
March 31, 1847	713	13,157 2
June 30, 1847	1148	21,754 7
Sept. 30, 1847	1495	31,530 12
Dec. 31, 1847	1084	27,220 19
March 31, 1848	904	25,247 18
June 30, 1848	338	4,437 14
Sept. 30, 1848	1686	31,491 14
Dec. 31, 1848	749	15,781 17
Quarter of Current Year to the Sale, Dec. 7, 1848	1515	28,935 0

A further sale of 374 tons took place at Swansea, on Thursday last; the particulars of which are given in another column.

Having thus described to the fullest extent the Burra Burra Mine—the most prolific, perhaps, in the world—we shall conclude by a few remarks on the colony of South Australia generally, as published in a recent pamphlet, by Mr. J. B. Wilcock, of Plymouth:—"South Australia, of which Adelaide is the capital, is a most striking illustration of the rapid progress of successful British colonisation. In 1836, South Australia was settled over by a few migratory savages, and depastured by herds of kangaroos; it is now the happy home of thousands of Englishmen, busily and actively employed in rearing cattle and sheep, cultivating the soil, and working the rich and unequalled mines with which the colony abounds,

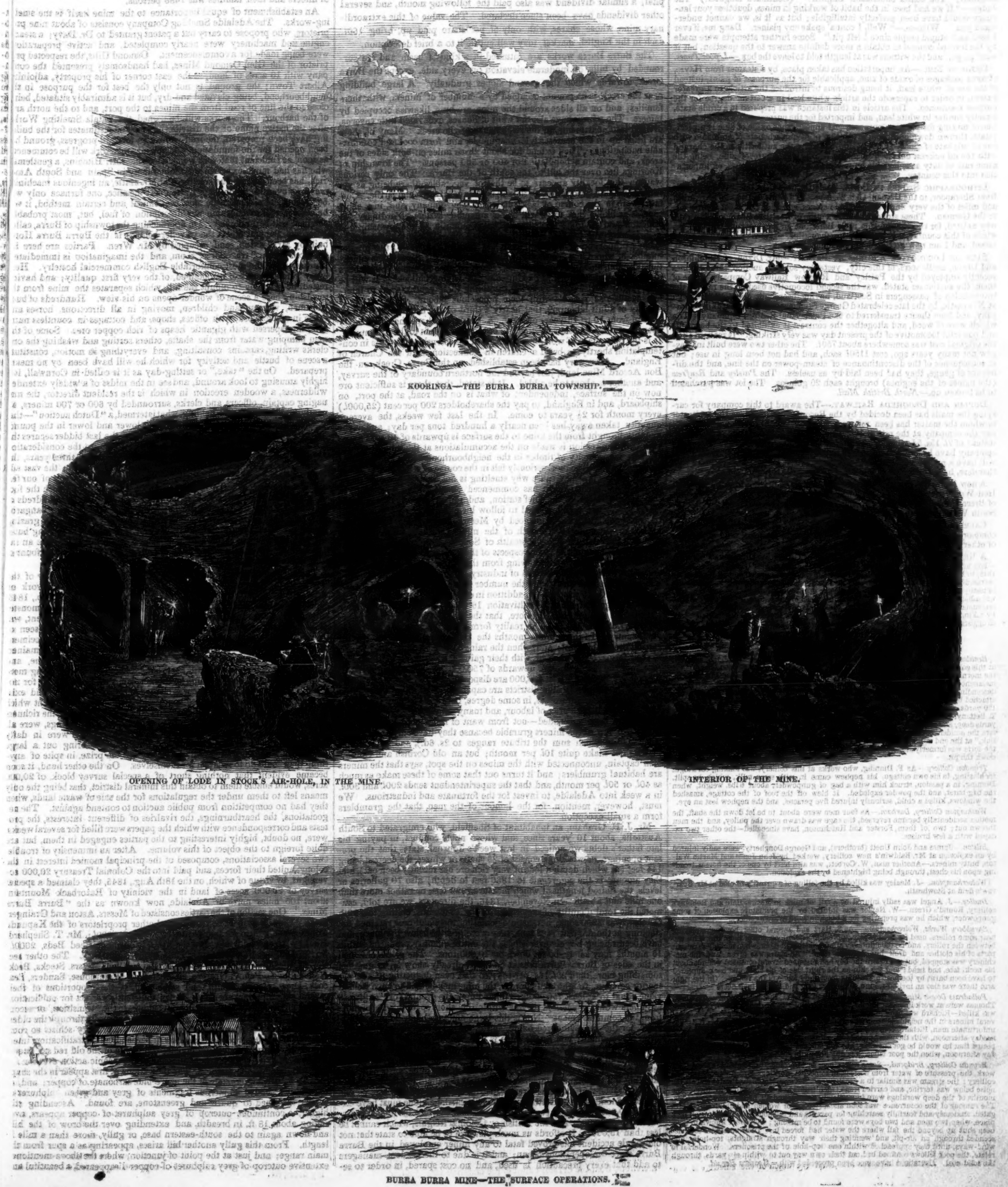
and who, whilst securing to themselves ample rewards for the industry and energy they display, are establishing a position of independence and comfort for their families to which they never could have aspired in England, and are laying the foundation of a mighty empire, which will probably exercise the most important influence over future generations. The British province of South Australia was founded by an Act of the Imperial Parliament in August, 1834; but the first Governor did not arrive in the colony till December, 1836. It is situated on the south coast of New Holland, between the 26th degree of south latitude and the sea coast, and the 132d and 141st degrees of east longitude, extending over 300,000 square miles, or nearly 200,000,000 acres of land, about double the size of Great Britain and Ireland, and possesses a coast line of about 1400 miles; of this vast region about 800,000 acres have been surveyed—nearly 600,000 of which are sold. The province is remarkable for its park-like scenery; one-third is estimated as good open agricultural or pastoral land, one-third as wooded ranges, yet well adapted for pasturage, and one-third rocks and scrub; but this latter portion, valueless for all other purposes, is found to contain rich and valuable mineral veins—the development of which appears likely to raise South Australia to a degree of importance hitherto untrivalled.

The harbour of Port Adelaide (a natural dock) is nearly eight miles in length, and can accommodate a vast amount of shipping; situated on the south coast of New Holland, it has the benefit of the whole indraught of the south-west winds, which prevail four months in the year. The colonial surgeon, after many years experience, says—"We are without any endemic disease; we have no marsh miasma, and consequently escape those dreadful remittent and intermittent fevers, so prevalent in India and China; we have all meats, fruits, and vegetables to be found at home, and if our days are warm our nights are cold and bracing." The average mortality for five years is less than 1 per cent, in England it is 2-13.

Adelaide contains handsome streets, judiciously laid out with shops and public buildings, which would be considered an ornament to any English town. The population of the city of Adelaide is about 10,000; and of the Port nearly 2000, including land proprietors, merchants, bankers, stockholders, clerks, assistants, and overseers; professional men, manufacturers, millers, brewers, shopkeepers, and retail dealers; with the various classes of mechanics and artisans usually found in an English town; it has banks, churches, chapels of various denominations, schools, and the various public and social institutions, which are found at home. The land produces from 25 to 35 bushels of corn per acre, and instances have been known where 40 to 45 have been gathered in. Sweet peas yield 40 tons per acre; arrow root, 4 tons; and maize, or Indian corn, from 70 to 100 bushels. South Australian wheat sold in England for 96s. per qr., when English wheat was selling for 60s. In November, 1845, 450 qrs. of South Australian wheat were sold at 76s., when English was 60s.—these 450 qrs. were freighted at 64 lbs. weight per bushel, upwards of 30,000 acres are now under cultivation. The country is intersected by numerous rivers, the Murray being the most important. The increase of stock is enormous. In 1839, the colony contained 109,700 sheep, and 7600 horned cattle. In 1847, they amounted to 1,000,000, and 50,000 horned cattle.

Such is, we believe, a correct description of this interesting colony, capable of sustaining the surplus population of Great Britain for ages yet to come; and where, by the slightest exertions, of industry, perseverance, and temperance, not only may a present living in comfort and even luxury be obtained, but a competence laid by for declining years.

We append some illustrations of the mine and works, from the drawings of Mr. J. B. Graham, for which we are indebted to the spirited proprietors of the *Illustrated London News*, who are ever foremost in presenting to the public scenes and descriptions of all that is important or interesting.



BOORINGA—THE BURRA BURRA TOWNSHIP.

THE MINE.

BURRA BURRA MINE—THE SURFACE OPERATIONS.

matist—"Brother, brother, we are both in the wrong." Such said we, or to the effect, last week; now, then, let us take the present.

On reference to another column, it will be seen that Mr. W. B. J. P. CAMERON acts in accordance with the proposition advanced by us—we will not say in pursuance of it; but glad are we to find that the views we entertained and expressed are thus met, or replied to, by the gentleman whose name we have quoted. It is not for us to enter into details on matters affecting any company, formed for working mines or collieries, although we are pretty ready to expose abuses; yet the letter before us, with the report of the committee, induces us to go a step beyond that which we have ever considered the *Rubicon*. As we stated last week, on the authority of the committee, something like 120,000*l.* has been subscribed by the shareholders, in carrying out the workings of the colliery; but, on inquiry (the information being rendered by Mr. HOWDEN, the secretary), we learn that, out of the 20,000 shares, of which the company is constituted, 12,000, or three-fifths of the shares and capital, is held by that gentleman—thus the real capital advanced is only 40,000*l.*, the residue being as part purchase-money. This does most certainly alter things, at the same time that it bears us out in the remarks of last week—that it is for the interest of "one and all" to carry out the working of the colliery; by which, if effected regardless of private interests, but with a view to that of the shareholders generally, we feel well assured will be productive of advantage to the one and other, regardless of prejudice.

We narrated, last week, the proceedings and position of the company. We endeavoured to steer between *Scylla* and *Charybdis*. We know neither one party nor the other. We believe there are grounds of complaint—there are reasons which may be advanced on the one side or other; yet we still advise both parties to avoid the lawyer's counsel and applications to the court of equity. We feel well assured that, in suggesting a conciliatory course, we do the shareholders much good. If the lessor be obstinate, he must take his chance; but, as appears from the letter before us, such does not appear to be the case—inasmuch that he, as the original lessor, and holding, as we have before observed, three-fifths of the number of shares, he comes forward with a proposition, which, if he can carry out, will, doubtless, be satisfactory, not only to the shareholders generally, but at once give a market value to the shares. The approach, on the part of the writer to something of a conciliatory nature, we hail with pleasure, and trust that the committee and shareholders generally, will, at the meeting to be held on the 10th January, 1849, meet the proposition put forward with kindly feelings. We must, however, for ourselves, say, that we do not fully concur with the writer; we could have wished his language couched in other terms. Assumptions are made, and conclusions arrived at, which have no ground; and, had the writer seen his letter in type, we feel assured he would, oft as required, "correct the press;"—however, the object we consider fair and honest; it is meeting difficulties and objections half way; and we think it behoves others to meet him in the same spirit. We will not attempt to analyse the letter under notice—it is for the shareholders to determine the course they will pursue; at the same time, we must repeat, we do not concur with Mr. CAMERON as to the position he assumes; but which will, doubtless, be arranged, as we hope, amicably, at the approaching meeting.

He may, and doubtless does, possess full confidence as regards the value of the property, as also equal confidence in being capable of carrying out the projected measures; but in times like these we require more than mere assertions, or opinions. Let the gentleman be prepared to give a guarantee, or security, for that which he holds forth, and we will listen to him. We do not mean for a moment to throw any doubt, but having hinted at the particular point, which, were we shareholders, we should consider as somewhat of moment, we leave to others to act as they think fit; while, we doubt not, Mr. CAMERON will be fully prepared to meet any question which may arise. In closing our observations, which are somewhat hastily thrown together, we have only to say, one thing is quite clear—the shareholders, as a body, without regard to interest, opposed or combined, must take the "bull by the horns," or, in other words, the thing is in their own hands. The board of directors must be demolished and reorganised—the committee must become defunct—the one and other must merge as shareholders—then let them put their shoulders to the wheel, without regard to prejudice or interest. Let then a meeting of the shareholders be convened—throw overboard all "opponents"—appoint good-working men as directors—have meetings every three or six months—let the hive be protected, and the "drones" shelled, and no fear need exist but that the busy bees will produce some honey, and yield to those who support them a return which will, we hesitate not in saying, equal, if far not more so, the expectations ever entertained.

The adjourned meeting of the ABERDEEN RAILWAY COMPANY took place at Aberdeen, on Wednesday, at which certain of the directors were thrown out of the direction—their conduct and mismanagement having created the indignation of nearly all the proprietors, and by which they had entirely forfeited their confidence. We understand that several of these gentlemen are directors of the North British Australasian Company, the yearly meeting of which was also to take place at Aberdeen on Thursday. What the result of the latter has been we had not learnt on going to press, but we apprehend that the marked expression of disapproval which occurred the previous day, could not fail to have its effect.

Indeed, the details we have recently given in these columns, with regard to the latter company, would of themselves have been sufficient to determine the course to be pursued by the partners in electing directors for the ensuing year; but we hardly believed that the same parties were involved in another case, in which they were nearly equally deserving of censure. We believe that circumstances which have recently come to light, are "better imagined than expressed." Certainly, the shareholders of the North British Australasian have even greater cause to complain, and to desire a similar process to improve their position. We shall give a report of the meeting next week; but whatever may be the result, we shall not cease to keep the matter in view, and to give the shareholders our humble advice.

The electors of the highly respectable borough of Truro are in much the same circumstances as the electors of the sister borough of Liskeard, in so far as both are seeking a new Member to serve them in the Commons House of Parliament, in place of the two distinguished representatives they have recently lost. Mr. E. TURNER died, as our friends in the county of Cornwall are painfully aware, at the house of his son-in-law, at Pimlico, on the morning of the 8th inst. In him, we do not hesitate to say, the county has lost one of its most able and indefatigable representatives. A man of perfectly honorable and independent conduct in Parliament, and practically acquainted with the great and peculiar interests of the district he represented. To our minds, it is some compensation for the loss the mining community has sustained by the removal of Mr. TURNER, that the gentleman who will probably succeed him is as familiar with the true interests of Cornwall, as a mining district, as his predecessor was, and that there is just reason to expect that his Parliamentary career will be as honorable, as independent, and satisfactory to the county, as that of the gentleman whose seat he aspires to occupy. Mr. HUMPHREY WILLYAMS is scarcely an untried man—his name has long been pre-eminent in the public business of both Truro and the county, and we know he will bring with him into the larger sphere, the more illustrious orbit in which he seeks to move, those business qualities which will make his presence

all the more welcome to the House and the more advantageous to his constituents. Neither is it to our minds the least of Mr. WILLYAMS's recommendations, that he is hereditarily and by descent a Cornishman, and, as a matter of course, possessed of the habits and qualifications proper to a person bred up in the district he seeks to represent, and also more absolutely within the knowledge of the wooded constituency than could possibly be the case when a gentleman is specially imported for the occasion. If the county wants really useful and working members, there are a plenty of independent residents within its own bosom worthy of its choice, and competent to transact its affairs with propriety in the Imperial Legislature.

Truro has always been considered to be under the special patronage of Lord FALMOUTH; but we believe that nobleman uses his influence with great moderation, and with a considerate regard to the wishes of the electors. We can entertain no doubt whatever that, on this occasion, he will do nothing to thwart, or restrain, or to control, the unfettered use of the franchise by the electors of Truro, when they assemble under the statute to choose an individual, familiar with mining interests, to represent a great mining district. Considering Truro as being the nucleus of an extensive mining circle, an acquaintance with, and a determination by all possible means to promote that species of industry, are qualifications in their Member which, we may take leave to say, the electors should at this moment deem imperative and indispensable.

REVIEW OF MINING DURING THE PAST YEAR.

BY J. Y. WATSON, ESQ., F.G.S.

The annual review I have been accustomed, for some years past, to write you, must necessarily be short this Christmas; the "Compendium" having trespassed too much upon my time to allow me to keep up my usual chronicle of events; and this article will, at least, have one good quality—that of brevity. In the review, in your paper of the 1st January, 1848, it was stated, that in no year had changes and fluctuations been so great as in 1847. In the early part of 1848, however, mining was even more depressed than ever, it became a serious consideration whether many of the largest mines in Cornwall could continue to weather the storm. The smelters, revelling in their monopoly, bought ore at ruinous prices to the miner, and, consequently, at more than ordinarily remunerating prices to themselves; but it must be said, in justice to them, that the continental markets for their metal being shut, and trade and credit almost annihilated at home, their stock of copper was increasing to a vast extent by their large weekly purchases, and which, at last, they would not make, except at a standard lower than had been known for years. On this account it was determined, in the early part of the year, by the managers of some of the principal mines, to reduce their returns of ore to a quantity just sufficient to leave a small profit—whilst, among others, some barely paid cost, and some divided half their usual rate of profit: the consequence is, our dividend list shows a less amount of money paid this year, but it also enables us to say, the mines have improved in proportion—larger reserves of ore having accumulated in their different levels, and which will be brought to market when the price improves.

It may be added, that a few months since mining property was at its lowest ebb, and it has since rose rapidly in public estimation, and the difficulty is now, not in finding buyers for shares, but in finding shares at prices that numerous buyers are willing to give. We can only account for this from the publicity given to mining property by the daily press, the large interest paid by the best mines, and the knowledge of the fact, that in the well conducted, where the accounts are audited, and profits divided every two months, there is no fear of any liability, and the exact state of the company can be ascertained at any time by all.

In the year 1847 the dividends paid by 30 mines amounted to 155,381*l.*; this year only 22 mines have paid, and the amount is 129,024*l.*; of these 22, Bedford United and South Basset did not pay in 1847—making, therefore, 10 mines in the list of 1847 not in that of the present year—viz., Tresavean, Great Consols, East Crofty, Levant, Callington, Wheal Sisters, Wheal Vyvan, Wheal Franco, Wheal Bal, and Ballewidden.

With this short introduction, we give the list of dividends:—

Dividends Paid by Cornish and Devon Mines in 12 months, ending Dec. 31, 1848.				
	Total div.	Amt. of div. p. sh.	Paid-up.	Market pr.
Devon Great Consols.....	£30,720	£30	£1	£230
East Wheal Rose.....	25,500	200	50	650
Carn Brea.....	14,000	14	15	90
Far Consols.....	12,800	100	900	800
Wheal Seton.....	8,415	85	150	750
North Pool.....	7,750	775	45	500
South Francis.....	5,046	46	160	240
Wheal Margaret.....	3,136	28	10	250
South Caradon.....	3,840	30	5	400
United Mines.....	1,000	10	—	400
Wheal Friendship.....	2240	—	—	—
West Caradon.....	2,460	10	20	180
Bedford United.....	2,000	—	20	3
Tresavean and Barrier.....	2,180	218	10	200
North Croft.....	1,830	13	—	200
Trehane.....	1,472	53	2	30
Trethellan.....	1,200	10	20	15
South Basset.....	1,280	10	—	140
Treleigh Consols.....	1,000	—	63	2
Stray Park.....	500	—	64	18
West Providence.....	409	14	1	11
Wheal Spear.....	286	2	10	—
Total amount of dividends, £129,024.				
Dividends Paid in Public Welsh Mines.				
Lisburne.....	£3500	—	—	—
Goginan.....	3000	—	—	—
Rhoswiddol.....	406	—	—	—
Total amount of Welsh dividends, £6906.				
Dividends Paid on Foreign Mines in 1848.				
	Dividends.	Per Share.	Price.	
St. John del Rey.....	£13,650	£14	£12	
United Mexican.....	10,733	5	4	
Cobre Copper.....	10,000	1	13	
Total amount of foreign dividends, £34,443 10s.				

Of mines likely to pay dividends in 1849—Trelawny, Condurrow, West Seton, South Tolgus, and Herodsfoot, are already leaving profits; on the latter a call of 4*l.* per share has just been made, to pay for new machinery. Twelve months since we urged this measure, and had it then been done, dividends would have been declared ere this. Trelawny will pay a dividend in the middle of January. Among the new and promising mines put to work during the year, Wheal Tregordan, and the East and South Tamar are going on well—whilst it is pleasing to see the market has become weeded of many of the companies formed by needy adventurers, and which only brought discredit on mining in general.

Other mines, such as West Buller, West Frances, and West Tolgus, in the western district, and Wheal Mary Ann, &c., in the eastern, are showing great promise.

The statistical accounts and general particulars of the various mines being now in course of weekly publication in the Journal, it is needless to refer to them more particularly here; we will, therefore, merely notice the principal transactions during the year. In Devon Great Consols several hundreds of shares have changed hands, at prices varying from 180*l.* to 220*l.* each, the latter being the present price—showing a rise of 20*l.* per share, or 20,000*l.* on this property, since this time last year. In East Rose, shares have fallen from 1300*l.* to 600*l.*—a fall for which no satisfactory reason can be shown. If statements are to be relied on, the mine can pay good dividends for years to come; but, being deep and expensive to work, the slightest falling off in its returns seems to cause a scramble to sell, and, in consequence, shares fall below their value. Wheal Seton,

last year 1200*l.*, dropped this to 600*l.*, but have since rallied to 700*l.*, and are considered extremely cheap, although the dividends paid are not large. Callingtons have fallen from 33*l.* to 15*l.*, which is scarcely to be wondered at, considering the heavy working cost and expensive management. Among the mines where improvements have taken place in price are South Frances (200*l.* to 230*l.*), South Basset (80*l.* to 150*l.*), West Caradon, Condurrow, West Seton (150*l.* to 230*l.*), Trehane (20*l.* to 30*l.*), Wheal Henry (10*l.* to 40*l.*), and East Pool (20*l.* to 40*l.*); of these all are paying dividends, except West Seton, Wheal Henry, East Pool, and Condurrow, but which we hope to see in the dividend list of next year.

The United Hills Mine, abandoned by its old company, and which was announced in our last year's article as having been taken up by PRINCE ALBERT, has thus far disappointed expectation, although a large sum of money has been spent.

The rise in the price of tin is favourable for tin mines, and the old mines of Polberow and Polgoth have been put spiritedly to work.

In Cardiganshire, several mines have been put to work of late, among the principal of which are Cwm Erfn, Bwlch, Nant-y-cri, and Bodcall. The operations, excepting at Bwlch, are not at present on an extensive scale, but show favourable indications of remunerating the shareholders for their outlay; indeed, it would seem that the attention of miners has not hitherto been sufficiently directed to the mineral wealth of this county.

The vast quantities of copper ore coming from Australia is rather alarming to the Cornish miner, though counterbalanced, in some degree, by the falling off in the returns from the mines of Cuba, which a few years ago sent such amazing quantities into the market. Should smelting be established in the colony upon an extensive scale, large quantities of ore, which now will not pay the freight and charges to England, will be smelted on the spot, and sent to market as copper. Altogether, the mines of South Australia are becoming of such importance, that a slight notice of them here may not be uninteresting.

The first discovered was the Kapunda Mine,* 45 miles from Adelaide. It was purchased, in 1842, for 80*l.*, or 1*l.* per acre, and has returned upwards of 3000*l.* tons of ore, yielding from 20 to 50 per cent. of copper, and realising about 19*l.* per ton at Swansea. A steam-engine is employed, and the returns were, in 1844, 252 tons; in 1846, 1386 tons; and in 1847, 1332 tons.

The Montacute Mine was discovered in 1844, and purchased for 1550*l.* In 1846, 503 tons were sent to England, and in 1847, 100 tons. The original company was, in 50 shares, of 100*l.* each, but, from the returns as shown above, the operations were not profitable, and this mine is now, I believe, leased to the Australian Mining Company (London). The ore found yields from 18 to 30 per cent., and has to be carried to Adelaide, over a ridge of hills, at an expense of 1*l.* per ton.

In 1845 was discovered the extraordinary mine, Burra Burra. It is 86 miles from Adelaide, and was originally purchased, in September, 1845, by a few individuals, for 20,000*l.*, being half a special survey. The company holding the northern half (Burra Burra), called the South Australian Mining Association, is in 2404 shares, of 5*l.* each, and the profits made in nine months returned the proprietors 600 per cent. on their capital. The ore yields 40 per cent., and in 1846, 4564 tons were shipped to England; in 1847, 6825 tons, whilst the quantity raised during the year ending March last, was 13,583 tons.

Among other mines returning ore, there are the Kanmantoo, in the Barker district, belonging to the South Australian Land Company (London), which is returning about 300 tons per annum. The Paranga has returned about 200 tons.

The Australian Mining Company of London, in 20,000 shares, of 3*l.* per share paid, are working the Montacute, before referred to, and also Tungillo and others, at Reedy Creek, 35 miles from Adelaide, and have commenced raising ore in large quantities, and we believe the first cargo is now on its way to England. The management is under Capt. Phillips, formerly of East Pool.

At Glen Osmond, lead ore yielding 75 per cent. of lead, and 18 ounces of silver to the ton is found. The Cornish miners, however, have not much to fear in regard to Australian lead mines, as it appears that in 1846 there were shipped 71 tons, and in 1847, 144 tons.

The Barossa Range Mining Company are working the Greenock Creek Mine, and another at Lynedock Valley, from both of which they are, according to last advices, raising good ore. This company have other sections in the Mount Barker district, but intend, at present, to confine their operations to the two above named. The shares, 6000 in number (1*l.* 8s. per share paid up), are held by parties of the highest respectability in London, and the management of the mines under Capt. Rodda, an old experienced Cornish miner, and who has discovered several large lodes; one in particular, at Lynedock Valley, of large size, and, according to his past official report, 2 feet nearly solid ores; another lode here contains grey and yellow sulphurets, yielding 25 per cent., and most of it also has 1 oz. 12 dwts. of gold to the ton.

Of the gold mines of California, so much talked of just now, and which are to create such a revolution in the value of metals, we shall be better able to speak next year (if we live so long); but, perhaps, it may be found, ere then, that yellow mica strangely resembles gold in the ore.

This article, meant to be brief, has run to greater length than was intended; and, in conclusion, may the mines, during the coming year, be prosperous to "One and All."

GOLD MINES IN ENGLAND.—While we have American returns of gold mines in California, and mineral riches abroad, we are well pleased to find that at home parties do not lose sight of the precious metal. It is well known that our metalliferous rocks and lodes yield gold and silver, although, in most instances, too minute to render them of any commercial value, and, generally speaking, being found in the gossans. It is now some months since that attention was directed, through our columns, to the produce of gold in Merionethshire, and although the question may be open, as to whether the sovereign is obtained *minus* or *plus* the value, yet the fact has been elucidated, that the mineral lodes in North Wales yield gold a bar of which, weighing 3 lbs. 7 ozs., has been placed in our own hands, as the product of the East Cwm-hesian Mine, near Dolgelly. The mine is worked for lead, and the lode is represented to us as being "interlaced" with strings of gold. Some 6 lbs. or 7 lbs. of the precious metal have been obtained, and the ore at bank will, we are informed, yield at least 200 ozs. of gold. We merely mention the circumstance, with the view of directing the attention of our readers who may possess information on a subject so important as that mooted—the extraction of gold from our mineral veins. We are well aware that the question is one of pounds, shillings, and pence, and having noticed it, we leave it to others to enter into further detail.

HUTCHISON'S INDURATED SANDSTONE.—It is with much satisfaction we find that the soft stone, and other materials, indurated by Mr. Hutchison's process, and to which we have, on several occasions, called the attention of our readers, is rapidly advancing in public estimation, from its peculiar and advantageous properties. Several troughs, mangers, sinks, &c., which were exposed to the weather, at the works near Tonbridge Wells, were full of water; and, on the approach of the late short though severe frost, this water became converted into solid ice. During the expansion which necessarily took place, the indurated stone remained entirely unaffected, while the ice itself burst and bulged in all directions. The specimens of pavement, also, in the town remained perfectly dry, and free from ice, while every other footpath was dangerously slippery. This latter property is, of course, owing to the bituminous matter introduced, and which renders it so desirable for paving the basement stories of houses, keeping the foundations dry, and the lower apartments warm. There are properties in this material which cannot be too highly appreciated for building and paving purposes.

* I am indebted for the principal statistics to a pamphlet on South Australia, by the Editor of the *South Australian News*.

the same time, to seize the *Koh-i-noor*. The "Nasuck" diamond, plundered during the Marhatta war from a Peshwa, or feudal chieftain, is a kindred exploit. Such is a faint lineament of the countless and curious adventures of this imperial and oriental gem—a real romance!

Portland-place, Hull, Dec. 26. J. MURRAY.
P.S.—Should any of my friends, readers of the *Mining Journal*, be desirous to peruse the history and adventures of the diamond—my *Memoir on the Diamond*, second edition, with plates, printed on the first and only paper made from *phormium tenax*, or New Zealand flax (a curiosity of another kind)—the few copies I have left (20 in all) are at their service, at 4s. No future edition will ever be printed by me. These could be sent to the office of the *Mining Journal*.

THE CONVERSION OF THE DIAMOND INTO COKE.

Sir,—The remarkable discovery of the conversion of the diamond into coke has been recently assigned to Dr. Faraday; I must, in justice to myself, however, claim the priority, and simply quote, in conclusive proof, an extract from my *Memoir on the Diamond*, second edition, 1839, p. 83.

"LITERA SCRIPTAMANET.—I embedded a fragment of diamond in a nidus of hydrate of magnesia, and having submitted it to the intense flame of this powerful though dangerous instrument (the oxy-hydrogen blow-pipe), the diamond parted suddenly into minute fragments, displaying on their surfaces, as determined by the lens, the conchoidal fracture, and became as black as jet!"—J. MURRAY: Portland-place, Hull, Dec. 26.

CHESTNUT BREAD.

Sir,—M. Payen has recommended bread composed of chestnut meal, either alone, as a substitute for, or mixed with, wheat flour. I have always considered the chestnut all but indigestible. True, I have seen it the exclusive food of families among the Apennines, on the principle, I suppose, on which donkeys eat thistles, when they can get nothing better. Dr. Johnson said, that oats were food for horses in England, and men in Scotland. In like manner chestnuts are the food of the wretched mountaineers in Central Italy, and form aristocratic diet in "Merrie Old England." That prince of fabulists, good old Æsop, has made the roasted chestnut a "cat's paw" affair. The "Caragonee moss" is the food of poverty-stricken Ireland—the English epicure converts it into *blanc mange*, to take its place among the *entremets*. Poor Trotty Veek! and so with the *laver* of the English shore, and *dulse* of the Scottish coast. I have cultivated, with great success, the white sugar beet (*Betula blanche de Silésie*), and some of the roots, this season, have exceeded 7 lbs. weight each. Last year I had the sugar beet and wheat flour, in equal quantities, made into bread, also in proportions of one-third of the former to two-thirds of the latter. Both made truly excellent bread, and I entirely preferred them to the best wheat bread. I presented a quantity of biscuits, made in the latter proportions, to the council of the Royal Agricultural Society of England. These were every way equal to the very best biscuits, and might be preserved unaltered for an indefinite period.

Portland-place, Hull, Dec. 27. J. MURRAY.

BREAKING OF COAL-PIT CHAINS.

Sir,—I hasten to inform you of a melancholy accident which occurred this day in our neighbourhood: five men and a boy of 14 years of age were precipitated down a coal-pit, 110 yards in depth, at the Bentilee Colliery, Longton Potteries, through the breaking of a link in the chain, although six other men had just previously descended in safety. From the frequency of these afflicting accidents, my attention was long since turned to the subject, and I have invented a plan by which I trust and believe they may be prevented. It is a plan which may be applied to any coal-pit at a trifling expense, without derangement of the machinery, or loss of time in the working. I have addressed the Secretary of State on the subject, and am quite prepared to superintend the construction of this improved machinery, wherever it may be required. I shall feel greatly obliged by your inserting this short notice in your valuable Journal.

Hanley, Staffordshire, Dec. 23. WILLIAM HEATH, C.E.
[We shall be happy to devote space for a description of the invention, or for such further particulars as our correspondent may wish to give publicity to.]

PRACTICAL MINING.

Sir,—The data furnished by "A Mountain Collier" being insufficient to enable a mechanic to suggest the best practical method of applying a stream of water for the purpose mentioned in your last Journal, he will, perhaps, in addition thereto, state the depth of the pit, or the height the water is to be raised, and also the velocity with which the water flows through, or along the trough he has described. It is also desirable to know if the shaft be already sunk, and if so, its diameter or dimensions, and likewise what quantity of water is required, or expected, to be raised in a given time. Such data being provided, the most effectual method of applying the power at the least expenditure, may be devised.

Dec. 26. JOHN CURR.

WATER-WHEELS.

Sir,—Although very much the same question as I now intrude upon your columns was replied to in your impression of the 16th inst., I shall feel much obliged if you will permit the insertion of this, trusting that some of your readers, well conversant with water-wheel power, will be obliging enough to reply to it. *Fig. 1*, 2, and 3, are water-wheels, 20, 25, and 30 feet diameter; at *fig. 1* the water is laid on at A, an overshot; *fig. 2* at B; and *fig. 3* at C. The greatest height the water can be brought and laid on is 20 feet above the bottom of wheel-pit, Z, which cannot be sunk lower. Supposing each wheel to be 3 ft. wide, and the ladles 15 in. deep, which of the three wheels would do the most work, supposing each wheel to have the same quantity of water? and in case of water becoming scarce, which wheel would be the most effective, taking it for granted that each wheel had the same work to do? If any one of your correspondents will be kind enough to reply to this, showing at the same time proof of his reasoning, he will confer a favour upon your constant reader.—WATER POWER: Abergavenny, Dec. 26.

LECTURES ON AGRICULTURAL CHEMISTRY.

RESPECTED FRIEND,—I presume that the objection brought by "A Mining Captain," against Dr. Ryan's theory of agricultural chemistry, would have never been the light had he examined the subject more in detail; he thinks that plants cannot live on carbon, because they cannot live in it; yet animal life cannot be sustained in fluids which it may be capable of digesting. But here there appears to me to be an error in comparing the affinity of plants for carbon to breathing, as it seems to imply that the process of attracting and digesting gases is less the result of a chemical affinity than to a kind of instinct inherent to vegetable life. Yet that carbon enters the plant by the leaves has been proved by experiment. When finely powdered charcoal is strewn around the plants, on the hardened mould, they will grow with greater rapidity. Now, the carbon could not penetrate very soon through the ground, consequently it must have entered the plants by the leaves; but, possibly, an excess of carbon would be injurious to plants in some cases. I have seen samphire grow on hard rock—a substance from which it could hardly obtain a meal—so that it must have actually "lived on air;" yet, on removing one of these plants in rich mould, its pungent qualities were soon diminished, although it seemed to thrive luxuriantly.

Our friend alludes also to the trees of the New World, which he supposes could obtain but a small supply of carbon from the atmosphere; but it is well known that the proportion of carbon in the atmosphere is nearly the same all over the globe, probably because each gas is as a vacuum to another gas—a fact long since proved by Dalton. If the plants are not injured by the carbon, it is because they absorb it as fast as it is produced. "J. L." says, that "some plants will thrive in an atmosphere of hydrogen," which, I believe, is equivalent to placing them in a vacuum, but that "no plant will exist in carbonic acid gas." Nothing could be more to the point to prove that the plants are supplied with organic matter by the leaves, for if the leaves were of use simply to extirpate the superfluous gases, the carbonic acid gas would aid, rather than retard, the process, by attracting the gases to combine with it. The fact that a plant will live after all the leaves are cut off, proves simply that it will not starve while it can help it, for, in obtaining carbon by the roots, it is simply what may be termed an effort of Nature to regain what had been lost. When the root of a tree is exposed to the atmosphere, it soon assumes the appearance of a branch, and no doubt acts as such; but, of course, if the roots are cut off, the plant will be destroyed, as they are to a tree what the stomach is to animals;

but another experiment which has been made must prove, beyond a doubt, that plants receive their nourishment from the atmosphere. A young tree was planted in mould which had been previously dried in an oven, and weighed, and during six years nothing was added but pure water; the tree grew to a considerable size, and on removing and drying the mould it was found that its weight was exactly the same as at first! But it is probable that it would have grown more rapidly in a richer soil, although it is probable that the plants absorb a great deal of the manure through the leaves, in the shape of decomposed organic matter, which must exhale from the ground.—JOHN DE LA HAYE: Liverpool, 12 mo. 26.

WENTWORTH'S BORING APPARATUS.

Sir,—I have not seen in your valuable Journal any notice of a miner's boring apparatus for excavating holes for blasting rocks, &c., lately invented and patented, a description of which I cannot but think would interest many of your readers. The origin of the invention I understand to have been this:—Daniel Watney, Esq., of Wandsworth, being the proprietor of certain iron ore and other mines in South Wales, on a recent visit was much struck with the great length of time and expenditure of labour required in boring holes for blasting the rock; and, on returning to town, requested Mr. John Wentworth, of the firm of Wentworth and Sons, engineers of Wandsworth, to direct his attention to the subject, with the object of devising some plan for the saving both of time and labour. The result was the invention of the apparatus above alluded to, which, it appears, is very compact, and occupies but very little space; it was taken down to Wales, and the most able hand at boring (as now practised) was selected from the miners, and who was desired to select his own spot, and work in what direction he pleased. He chose the horizontal direction, as most easily worked. The apparatus was now fixed, and the work commenced at the same time, but ere the miner had completed the proper length of his bore, the apparatus had drilled, I believe it was no less than six holes in the hard rock, and all of the proper length, and in different directions horizontal, at an elevated angle above, and depressed one below, also both right and left, and directly overhead, and this without moving the apparatus. In fact, the apparatus when once fixed, I understand, will work in every possible direction, and is, therefore, exceedingly valuable to the mine-owner. I think your mining friends would be glad to see a description of the apparatus in your Journal.—JOHN MULLINS: Battersea, Dec. 22.

THE BANK CHARTER ACT.

Sir,—Without offering any opinion on the papers on this subject, in your late Numbers, I beg to correct an erroneous inference which the writer draws in favour of his views from the statistics of iron-making in the Forest of Dean. The figures are in themselves incorrect; but what vicissitudes have occurred in iron-making in the Forest of Dean, have arisen from the nature of the materials, not of the banks. The remarkable deposit of calcareous ore in the Forest has been worked in times far beyond human tradition as deep as the natural drainage would permit. Caverns, hundreds of miles in extent, have been deprived of their contents, round the circumference of the basin, to as great a depth as they were found water free. This limit was of considerable extent, because the vein crops at elevations of several hundred feet above the sea, and more than 100 yards of the carboniferous limestone lying under it—the joints of which are very pervious to water; the drainage of the vein was very nearly correspondent with the river drainage of the vicinity. The old miners, availing themselves of this facility, had ransacked the best ore for the ancient bloomeries; and, when the first attempts in the Forest of Dean to smelt iron with pit-coal were made, there remained only an uncertain refuse of poor ore, mineralised with carbonate of lime, often to the extent of more than 80 per cent. The refractory nature of this compound, so different from the argillaceous ironstone, and the irregularity of its quality, defeated the first attempts to manufacture coke iron in the Forest. It was not until many years after 1825, when my father first, by expensive adits, and subsequently Mr. Crawshaw by a pumping-engine, had drained fresh tracts of the ore, so as to obtain an unimpaired supply of the whole vein, that the manufacture of pit-coal iron was established in Dean Forest. The statistics, therefore, which your author advances, bear no reference to his argument. No coke furnaces had surmounted the difficulties previously to 1825; and the statement of seven furnaces being in blast, and five out in that year, is absurd. There were not half so many furnaces in the Forest, including the ruins of those which had failed, and two or three small charcoal furnaces, one at Tintern Abbey, which smelted Lancashire ore with the poor Forest ore as a flux.

To attribute the increased mining and ironmaking near Glasgow to the effects of banking is equally erroneous. The invention of the hot-blast, and its application to the smelting of Mushet's black-band, were the sources of that increase. The Scotch banking system had no more power to create this prosperity than it had to prevent the failure of the Scotch iron companies last year. I do not know why Warwickshire (?) and Staffordshire are quoted as particular instances of suffering, because the table places Staffordshire and Wales in an equal position; but so far as they do suffer more in periods of depression, that is produced by greater subdivision of capital, and a smaller amount of profits arising from topical causes. The Forest of Dean is one of the most "favourably situated localities" in the kingdom for ironmaking. I perceive there are other errors in the table. If I understand your author's argument, he is one of those who think that those convulsions of over-trading and over-speculation, which are produced periodically by the accumulation of capital, would be prevented, or mitigated, by adding to them a facility for overtrading in bank notes also. Those who hold this opinion have a right to make the best of it, but they must be careful not to pervert into proofs of their theory natural events, with which it has no sort of connection.—D. MUSSET: Dec. 26.

Errata.—In my letter on "Copper Smelting," last line but one, for "have its use" read "have its use;" also, near the end of the first paragraph, for "completion" read "competition;" two lines beneath delete semicolon after "consumption."

ON THE CONVERSION OF IRON INTO STEEL.

Sir,—Some time ago I was led by circumstances to adopt certain opinions relating to the working and properties of malleable iron, since which I have read, with great attention, the numerous valuable papers on the subject appearing from time to time in the columns of the *Mining Journal*; but none with more interest than a letter from Mr. David Mushet, which appears in the Journal of the 16th inst. Your valuable correspondent, Mr. Mitchell, being now engaged with assays and analyses connected with this most interesting and important subject, I am desirous of contributing my mite to the general fund for furnishing materials to work out a satisfactory investigation; a few crude ideas, and the statement of simple operative facts, may direct his attention to points previously unthought of. Having occasion to refer to my diary, I will extract the first record I made of my ideas, done at the time with a particular object in view, which I will afterwards state.

"1846, January 18th, Sunday, Dalton-in-Furness.—Malleable iron, in a good working state, is not pure metallic iron, but a compound, or rather a mixture of metallic iron and one of its compounds, commonly termed cinder, but to which it is proposed for the present to give the term carbide, as a distinction—the term cinder being applied generally to all waste or refuse about iron-works, and regarded, in the elegant language of the art, as muck, trash, &c. The establishment of this fact will be of the highest importance, since it will not only clear up much which has hitherto appeared paradoxical, or mysterious, in the working of iron; but it may point out the mode of operating, so as to ensure good workable iron, and cause considerable saving in labour, fuel, and waste of metal. The presence of this cinder, or carbide, in iron is in fact the essential principle of welding, and without it iron will not work freely. As the new name is intended to signify, it is iron combined with oxygen and carbon, for which iron at a high heat has a powerful attraction, in a smith's fire absorbing the former from the blast, the latter from the fuel, and thus coming to the welding state; or in a reverberatory furnace, absorbing both from the atmosphere of the furnace. Heat alone is regarded as the sole agent in working iron, and when high heat is applied and fusible matter seen running from the iron, being considered as so much impurity, the heat is increased and continued, with the mistaken notion of purifying the metal, causing unnecessary waste of metal and fuel, and then pains being taken to free the iron from a combination necessary to its free working, more must be formed at each subsequent heat. On the contrary, if at the commencement of working, the iron is fully charged with carbide, and, during all subsequent operations, care be taken to retain as much as possible, the iron will be found to work freely, no more heat need be applied than merely to melt cinder; when finished the iron will prove of good working quality, and a great saving of material, time, and fuel be effected. As an illustration of this doctrine, the working of scrap-iron may be taken

as an instance. A bundle, composed of a great number of small pieces, presenting innumerable surfaces, which from its rusty state being so disposed, absorbs rapidly the gaseous compound from the atmosphere of the furnace, and the mass thus becomes fully charged with the elements of cinder, which in the subsequent operations is not worked out, but thoroughly worked in, producing iron of the best workable quality.

These, with many other remarks, were penned for the consideration of gentlemen engaged in iron-works, where I had been operating upon cinder, red ore, &c. I found that the rich red iron ore, the peroxide of iron, and any carbonaceous matter, as charcoal, coke, or coal, when heated suddenly and fused, ran into cinder; but the same materials, kept at a full red heat without fusion, formed granulated metallic iron, and if this was brought to a state of fusion, by the action of the heated atmosphere of a reverberatory furnace, it went to cinder also. I then tried the effect of preparing granulated iron as above, covering it up with cinder previously prepared, allowing it to fuse and run down into the granulated iron. In this way I got balls of iron out of a puddling furnace; but not having the opportunity of working them while hot, they were allowed to cool, and had to be re-heated before being worked. As is very generally the case, there was a strong hostile feeling on the part of the operatives against any innovation, and the balls were mostly broken under the hammer, not being sufficiently heated—in fact, the balls when broken were quite black in the middle; yet still, in spite of every pains to break the balls, keeping the hammer for a length of time on the same part, some were so tough that they would not break, and were worked into bars. The iron was represented to the principals as much inferior to that made with pig-iron, and I could not induce them to carry out my plans. I brought away with me some pieces of the broken balls, and had them worked by an experienced blacksmith, who pronounced the iron excellent. I have not had an opportunity since of following up this inquiry; but from the discussion in your valuable Journal, and my own conclusions, I am inclined to entertain the opinion that there is no true carbure of iron. When carbon and iron are in actual chemical combination, as in the cinder, or compound I have termed carbide, they are united through the medium of oxygen. Uncombined or free carbon, applied to such compounds at a high heat, without access of air, will reduce the iron to the metallic state. I feel disposed to suggest, that in white cast-iron the iron may be slightly oxidised, and the carbon chemically combined. The application of free carbon to this, with heat, may attract the oxygen, leaving the iron nearly in the pure metallic state, and the carbon dispersed through it, as a mere mechanical admixture, and in the state of graphite. The productions of graphite, or keesh, instanced by Mr. David Mushet, may be accounted for upon this principle; and, indeed, so may the natural formation of graphite, through the agency of water. In the latter case, we may suppose iron slightly oxidised in combination with carbon, acted upon by water, under circumstances favourable to the formation of carbonic acid; the iron would pass off in solution, leaving the surplus carbon behind in the state of graphite. I have already trespassed more upon your space than I intended; but will hazard one speculation more, which is, that the conversion of iron into steel appears to me to depend rather upon the abstraction of oxygen from the iron than the absorption of carbon; the rising of blisters seems to indicate an escape of gas from within.—T. H. LEIGHTON: Dec. 22.

CARBON AND IRON.

Sir,—Your correspondent, Dr. Murray, has been a little too hasty in classifying the expression, "gaseous carbon" and "inaudible explosion," under the same head. At a certain temperature the carbon becomes gaseous, and penetrates, or enters, into the iron, constituting a mixture of iron and gaseous carbon, called steel. At a lower temperature, the carbon is not found to penetrate the iron, and is, therefore, I presume, not in the gaseous state; and when, under a sufficient temperature, the iron has become saturated with gaseous carbon, any reduction of the degree of heat will condense this gaseous carbon—so that steel, in its ordinary state, is, or ought to be, a mixture of iron and condensed gaseous carbon. All that I have wished to impress is, that steel is formed by a mixture of iron and gaseous carbon, though both of these ingredients may be liquefied, or solidified, by various degrees of temperature, previously, or subsequently, to the formation of the steel. I quite agree with Dr. Murray in ascribing the varieties observed in the quality of steel to the incidental admixture of other matters besides carbon. These admixtures are unavoidable, when impure ores of iron, or ironstones, are reduced to the metallic state by the ordinary routine of smelting; and the steel obtained from iron thus prepared inherits defects proportioned to the amount of impure admixture imbibed during the smelting of the ores—hence the insuperable difficulty of making a perfect quality of steel from coke-iron. In charcoal there are present only exceedingly small quantities of oxidised bases—viz.: alumina, silica, &c., &c., but a considerable amount of alkaline matter, as potassa—far more than sufficient to determine the fusion and vitification of the injurious oxidised bases, at a temperature far below the melting point of cast-iron; therefore, in smelting iron ores with charcoal, the purity of the iron will depend solely upon the purity of the ores used. In coke, on the other hand, there is always a considerable admixture of oxidised bases—alumina, silica, &c., &c., with very little alkaline matter. Besides, the solidity and density of coke is far greater than that of charcoal, so that the pieces of the former, with the minute particles of alumina, silica, &c., &c., shut up within them, in solid carbon, are exposed for a considerable time to the intense heat of the melting region of the blast-furnace, and the particles are thereby deoxidised, and probably at once alloyed with the ferruginous matter of the coke, revived and metallised at the same time. A highly talented friend of mine ascribes the various qualities of iron chiefly to the degree of temperature employed in the smelting and subsequent treatment of the metal; and I think his views are exceedingly just. When no more heat is employed in the reduction of an ore of iron, whether pure or impure, than that which suffices to fuse the iron, the metallic result will be found to contain nothing but iron and carbon. Every oxidised base, whether alumina, silica, lime, barytes, &c., &c., requires a higher temperature for its deoxidation than that required for the fusion of cast-iron; therefore, when the heat is only sufficient to fuse the iron, no admixture of any other revived base can take place. The Swedish forges, working upon charcoal and tolerably pure iron ore, employ smaller furnaces, and lower degrees of temperature, than is the case in England, France, and Belgium; the iron, therefore, of the Swedish forges contains little else but carbon and iron, usually alloyed with a small quantity of manganese—a metal which is revived from its ore at about the same temperature as iron. In general, iron prepared in small quantities from the ore, by the agency of charcoal, as in the old bloomeries, is peculiarly fitted for steel-making; and the temperature in these bloomeries being necessarily very low, iron only was revived from the ore. Thus a cake of ancient bloomery iron, made in Dean Forest, from the calcareous brass iron ore, produced steel of a quality fully equal to the best Swedish, and without a trace of red shortness; whilst the same kind of ore, operated upon in a larger way, and with the modern improvements of increased temperature, yielded iron which was red-short from the first, and, when converted into steel, was entirely useless, from its cracking at the edges under the hammer. Again, when steel was prepared from Indian or Wootz ore by the ordinary routine of the blast-furnace, &c., it proved defective in some respects; but when prepared from the same kind of ore by methods which did not expose the materials to the injuriously high temperature of the blast-furnace, the steel was unquestionably superior to that manufactured from the best Swedish marks. I believe there is no ore of iron at present known so perfectly free from impurity as the granular Wootz ore, and when converted into malleable iron, with contact of carbon only, it produces iron, and subsequently steel, of a quality which Swedish iron can never rival; and this pre-eminence of quality I attribute to the fact, that all Swedish irons are, more or less, alloyed with manganese. Indian steel-iron being quite free from this injurious alloy, manganese, in alloy with steel, diminishes its magnetic power; and, if present to a large extent, steel retains no more magnetic power than soft iron. This observed effect of manganese affords a clue to the difference of quality observable in the various marks of Swedish iron. That Swedish iron, which, when converted into steel, can be the most strongly magnetised, and which retains its magnetic power the longest, is found to produce the best steel, this iron, I infer, contains the least alloy of manganese, and produces the strongest bodied steel; whilst, on the other hand, those irons which contain the greatest proportion of manganese will be found the least magnetic, and will, therefore, be ranked by the steel-maker as inferior marks. The natural steels of Germany retain a very feeble degree of magnetism, and are found to be comparatively weak-bodied. Manganese always predominates in alloy with these steels. The manganeseiferous iron ores of the Pyrenees produce also a ductile, but weak-bodied, steel. I have found that, when the best and most magnetic steel is fused with only a small part of its weight of copper, lead, tin, zinc, cadmium, chromium, anti-

money, bismuth, or arsenic, magnetic power is destroyed; whilst, when fused with each part of its mass of manganese, the magnetic power is much diminished, or rather altogether annihilated. When 5 per cent. of manganese is added, the steel adheres readily to the magnet; but it retains not a trace of magnetic power in its mass. It possesses still all the characteristics of steel; but, when formed into cutting instrument, it will bear no hardship, nor does it possess the peculiar penetrating edge of a good steel instrument.

Some processes are at present, I understand, in embryo for desulphurising common iron, and thus fitting it, as is imagined, for steel-making; but however desirable it may be to rid of the sulphur, still, unless the host of other, and even more injurious, alloys of alumina, lime, silica, baryta, magnesia, &c., can also be expelled, no good steel can ever be produced. I have in my possession some of the so-called plumbago from the guns of the *Royal George*, but even being soft and light, it seems to possess no other characteristic of plumbago. It appears to me exactly like the spongy residuum obtained from pure grey cast-iron, when the latter is immersed for some days in dilute hydrochloric acid. Notwithstanding again to the gaseous carbon, I may remark that the gaseous carbonic acid in limestone exists in its condensed, or, if I term it preferable, solid state; but a certain degree of temperature brings it into the gaseous state, and if fusion be now induced, either speedily or under pressure, the limestone retains its gaseous carbonic acid, and forms a stone. Something analogous to this seems to me to take place with steel & gaseous carbon.

Coleford, Dec. 26. R. Musher.

IMPROVEMENTS IN THE STEAM-ENGINE.

Sir,—I observed for some weeks past that one of your correspondents were discussing the merits of Mr. Weston's "Improvements for Obtaining and Applying Motive-power." In such discussion, a commendable reference was made to my engines by Mr. De la Haye, which Mr. Weston, in a subsequent letter has disposed of, by asserting that the application of my improvements to locomotives would necessitate the use of being of as great weight as the present system. It is, he says, this great weight that forms the chief objection to the present locomotive, and that of the great recommendations of his improvements is, that they will reduce considerably such weight. It is not my intention to criticise the originality of Mr. Weston's improvements, nor yet to attempt to disparage any actual value they may possess, but simply to occupy a defensive position which, as regards Mr. Weston, who has made his observations in a fair manner, it is sufficient that I refer him to statements based upon experiments long ago made, the account of which appeared in the *Mining Journal*, and may be seen in my *Lectures on the Steam-engine*, in which I have proved the practicability of carrying the Cornish system to the locomotive, and, at the same time, much reducing the weight of the engine, and dispensing with the tender. After having had nine years of practical experience, and the most ample opportunity of experimentally investigating the merits and requirements of the high-pressure expansive and condensing system of using steam, I must be obtuse indeed if I have not, by this time, attained a pretty solid practical knowledge of the subject, as well as of the distinct and definite views of the abstract principles. It is the privilege of Mr. Weston, and most other inventors, that they have the opportunity of meeting their opponents through the impartial columns of your and other technical papers; whilst I have to contend with the hole-and-corner assertions of men who lack arguments that will bear fair and open discussion. I am formidable only from the glossy and dogmatical style in which the protected positions enable them with impunity to indulge. One of the hole-and-corner arguments is, that there is danger in the use of my engine on account of my using high-pressure steam. This they make a most destructive argument against me, because few men, except scientific men, or those practically engaged in engineering, have had occasion to ascertain for themselves the principles upon which the danger or safety of steam boilers depend; hence these misrepresenting sophists, wide awake as to the means best adapted to attain their end, exclaim with the all-convinced argument—"But who would think of using steam at 100 lbs. to the inch? Perhaps these very practical and very scientific men will explain to us what more more pressure has to do in the bursting of a boiler than the mere surface upon which such pressure acts. Such explanation would bring out one of two things—viz.: that either they do not understand the matter, though they assume to be infallible guides, or else it must be apparent, that a too confiding public have in them guides so treacherous, that for selfish and unworthy purposes they sacrifice the best interests of humanity in thus artfully retarding the fuller development of resources so pregnant with good to the whole family of man, and, above all, so calculated to advance the wealth and greatness of England.

I know that to ascribe consequences so momentous to any improvement in the steam-engine will seem to some shadowy and unreal, and that the attaching such importance to one's own invention will lay one open to the accusation of egotism, if not of presumption. But, Sir, in the consciousness of as much modesty as my obstructors display, fortified, as I am, by the most certain of evidence that, by such improvements, our steam-vessels may be propelled to America and back with less fuel than they now require to go there—that the engines and boilers need not be half the weight as are those in present use, and yet be perfectly safe from boiler explosions; and knowing, moreover, that to Great Britain alone the advantages of the invention would be equal to a saving of 20,000,000l. annually, I say, with such advantages clearly provable, and having, as I have before said, been now for nine years endeavouring, in a truthful and honest manner, to introduce such improvements, surely it is somewhat excusable in me, if I feel that I have been treated in a most un-English manner by these hole-and-corner dogmatists.

Now, in the hopes of bringing my obstructors to the bar of public opinion, I ask them, will they, or will they not, grant me that the whole mechanical effect of steam is the result of its expansive principle? Will they, or will they not, grant me that such mechanical effect is in the exact ratio to the pressure under which the steam is generated, and the amount of vacuum obtained? Will they, or will they not, grant me that the practical mechanical combination I have introduced into boiler and engine are such as enables us to avail ourselves of the mechanical effect derivable from high-pressure steam, and that, too, in a safe and efficient manner, by which we obtain great power with a very small amount of fuel, and greatly diminished weight of machinery? Will they, or will they not, grant me that by diminishing the sectional area of the boiler in a greater ratio than we increase the pressure of the steam, the rendering force is less with high-pressure than with low-pressure steam? Will they, or will they not, grant me that all explosive mixtures are dangerous, in proportion to their volumes at given pressures, and to the instantaneousness of their liberation, which in the steam-boiler is effected by the almost instantaneous rending of the shell of the boiler? Will they, or will they not, grant me that the most dangerous effects arising from common steam boiler explosions are due to the great amount of sensible heat contained in so large a quantity of water when under pressure, as that necessary with the common boiler? Will they, or will they not, grant me that it is this heat pervading the whole mass of water, which on the boiler rending asunder produces instantaneously throughout the whole mass an immense volume of steam, and, consequently, is the cause of the most destructive effects.

I tell them that they must grant me these conclusions, because there is no wriggling out of them; for the physical laws are stubborn opponents—destitute of that pliancy which suits the sophist, ill adapted to receive that colouring which is so precious to the interested partisan, the envious, or the bigot. The physical laws, like their author, are no respecter of persons, but proclaim the truth with irresistible evidence, whether men will hear, or whether they will forbear. I appeal, then, to the physical laws; and, fortified as I am by abundance of practical demonstration of the safety, economy, and value of the invention, which is based upon such laws, I assert that the above premises must be granted; and I dare challenge one and all of my hole-and-corner obstructors to the disproval of any one of them in a public and becoming manner.

It is within the province of individuals to discern clearly the physical laws, to perceive those useful combinations, and to meet practical requirements by simple and efficient adaptations. It is within the province of individuals to explain, in a clear and truthful manner, the advantages which, in a variety of ways, such improved combinations are suited to confer upon the public. It is not unbecoming individuals to solicit encouragement from those whose interest such improvements are calculated more immediately to advance. But if these hole-and-corner men are permitted to shut up every avenue that can lead to the practical adoption of such improvements, why then they annul, as far as in them lies, those blessings which God has fitted the material elements to impart, and do all they can to convert into a curse those powers and capacities He has bestowed upon some men, by which they discover and bring these elements into subjection, so that they become the most powerful instruments for the improvement of mankind; adding to their physical comforts, expanding

and invigorating their intellectual and moral powers, bringing mind in contact with mind, and nation with nation, making apparent to the whole family of mankind that the highest interest of each is the good of all, and thus striking at the very root of those national jealousies, the consequences of which are restrictive laws and national wars.

But although it be permitted such men to defer the time when mankind shall enjoy such advantages, though immediate punishment is not the consequence of their thus injuring the individuals who are the means of bringing such advantages within the reach of their fellow beings, still these interested detractors may rest assured that, with whomsoever the truth is, it will ultimately come off triumphant. THOMAS CRADDOCK.

Birmingham, Dec. 27.

WEARDALE.

Sir,—Without the slightest wish, or desire to give offence to Mr. Cargill, I must flatly contradict his statement, to the effect that the Shotley Bridge clay ironstones are superior to the spathose ores of Wardale. The smelting of 7000 tons of Siegen "Stahlstein," by a British ironmaster, would, I have no doubt, afford him nothing but bad iron, simply because he would not treat the ore differently from a common ironstone. This would only prove want of skill on the part of the smelter, not inferiority of quality in the ore. The pure Wardale ores are precisely similar to the Siegen and Cornishian ores, which, it is well known, produce a quality of iron which, for tenacity, ductility, and fitness for fine work, is not equalled by any British product. I, therefore, conclude that Mr. Cargill did not treat the Wardale ores, or the pig-iron produced from them, in a proper manner, otherwise he must have obtained from them the very finest qualities of bar-iron. Of the astonishing ductility of bar-iron, prepared (on a small scale) from Stanhope iron, I have had ocular demonstration. It will even draw out at a faint red-heat without becoming hollow, as is the case with ordinary bar-iron.

Perhaps the most extraordinary part of Mr. Cargill's letter is that in which he states, that he had no motive for using the "ryder," yet it appears he smelted 7000 tons—a respectable quantity, certainly, where no motive existed for the experiment. The fact of such an immense deposit of the finest iron ore in the world existing unknown, within a few miles of the great mineral district of Newcastle, until within a few years, coupled with the fact that an eminent ironmaster only knows the mineral as "ryder"—a term applied to scores of various matrices, in various districts—indicates such an amount of ignorance and want of observation, that I, for one, feel not the slightest surprise, that Mr. Cargill, having smelted, without any motive, 7000 tons of this ore, was still unable to manufacture from it any good bar-iron.

It is quite natural for Mr. Cargill to consider his own ironstones as the best, and no doubt he really considers them to be so, for he can have no motive in depreciating the character of the Wardale ores, except as a mere matter of opinion. Since Mr. Cargill's ironstones are *illimitable*, and superior to those of Wardale, there must be certainly more than four hundred million tons of them. Under what unknown coal-field is this stupendous collection of ball ironstone concealed? Probably, in the *mare carboniferum* of geologists we may find this Utopian sett. A MINER.

Dec. 23.

GEOLOGY OF THE NEIGHBOURHOOD OF LIVERPOOL.

TO B. DONOVAN, ESQ.

Sir,—In acknowledging the compliment which you have been pleased to pay me, in last week's *Mining Journal*, I may observe that my acknowledgments are also due to Mr. Gladstone (to whom, as well as to yourself, I am an utter stranger), for he has, in the most candid manner, congratulated me upon the coincidence of our opinions. I find amongst my papers many notices regarding the connection of the red sandstone with the coalfields of Lancashire and Cheshire, which might lead to useful results, provided any accredited authority was organised to receive them; and your own observations do but show that if once the subject was adopted—so as to raise funds for a thorough investigation, with a comprehensive plan and report—that many material facts would be elicited towards the discovery of both coal and water. Your fears of the coal being injured by excessive pressure, are known in practice to be groundless, since we have instances of excellent thick coal in course of working under 300 fathoms of water. I perfectly accord with your remark, that as the theory now under discussion may possibly engage some controversy, it is very desirable that the papers should affix their names.—M. DUNN: Newcastle-on-Tyne, Dec. 27.

WRIGHTON'S PATENT AXLE-BOX.

The engraving represents a longitudinal section of the axle-box, in the most approved form, through the centre of the journal. A is the journal of the axle, which revolves in the brass step, C, fitted into the axle-box, B, which is cast in one piece, or otherwise so made, as only to leave an opening on its face, for the introduction of the journal of the axle. A disc of vulcanised India-rubber, which is compressed between the face of the axle-box and the ring, E, which works against a shoulder on the axle, and against which it is pressed by the elasticity of the India-rubber ring, and in both of which the axle freely revolves; a, a, are apertures at the sides, through which the grease passes from the grease-box to the journal and interior of the axle-box. The object of making the grease pass down the sides is to save diminishing the bearing surface of the brass, by drilling large grease-holes. The spring G, rests on the plate, F, which covers the grease-box, and carries the grease cover, H, made to fit sufficiently accurate as to exclude dust and dirt—the whole being secured to the axle-box by the bolts, b, b. In applying the axle-box, the metal ring, encircled by the India-rubber ring, should be first put on the axle; the axle-box, with the brass step in its place, being filled with grease, is then to be applied to the journal, and pressed towards the nave of the wheel, compressing the India-rubber ring, until the bearing drops on to its seat. The shoulder of the journal will prevent the axle-box from being forced back again by the elasticity of the India-rubber ring, which will press on one side against the face of the axle-box, and on the other against the metal ring, and keep it close up to the shoulder on the axle, and prevent the grease escaping, and dust or grit getting into the journal. It is quite unnecessary to apply pins, or fastenings, of any kind to confine the India-rubber ring—the adhesion between it and the face of the box, being much greater than the friction between the two metal faces.

The extreme simplicity and economy of the invention, with its great advantages, must be obvious from the description; the axle-box itself requires no fitting, polishing, or facing of any kind, nor the application of a polished plate fixed by bolts or screws. It may be used as it comes from the foundry; the only thing necessary to look to is to see that the plate and cover, close the grease-box sufficiently to exclude the dust and dirt; the metal ring need only to be turned where it is in contact with the axle. The shoulder for it to work against can be made either by turning the axle a little smaller, as shown in the engraving, or by driving or shrinking on a metal collar, faced and bored to fit it. The first method may be pursued when the axle-boxes are being fitted to new axles, or those not in use, and both can be placed under the carriages when required; but in applying them to axles under carriages in use, the latter method is preferable, as a number of collars may, if required, be prepared and shrunk or driven on, and the boxes fitted in the course of a few minutes. Common axle-boxes, of any description, may with little trouble and expense be altered to the patent ones, simply by making the metal joint in the middle tight, stopping the holes at the bottom left for the escape of the grease, and applying the metal and India-rubber ring, as shown—this alone would save a great expense to railway companies wishing to use the patent axle-boxes, and having a large stock of common ones on hand.

As a practical proof of the efficiency and economy of the invention, it will be sufficient to state, that after some experiments on the eastern Union Railway, a second-class carriage was fitted with the patent axle-boxes, which has now been running about four months, and has travelled more than 6000 miles without lifting, or requiring a renewal of grease, and at the present time there is not the slightest appearance of their requiring any, as the grease boxes are as full now as when first put to work.

COMBINED VAPOUR ENGINE.

We had another opportunity on Friday last of examining this engine in action, at Messrs. Horne's, in Whitechapel. In our previous notice of this invention, on the 9th inst., we mentioned that we were promised further particulars. We have since been favoured with a copy of the report sent into the French Government, relative to the working and experiments made by the Commissioners appointed for the purpose upon an engine constructed on the same principle in the month of July last. The following account of the working of the engine is extracted from the official report of M. Lafont, the chief of the Commissioners:—"The ether-hydric apparatus was constructed, in consequence of the favourable opinion given by the Board of Works as to the possibility of making use of the caloric (lost in the ordinary mode of condensation) to vaporise ether. Two engines, of ten-horse power each, were coupled upon the same beam; the one supplied from a boiler (for ten-horse power) acts in the usual manner, by the introduction of steam and its discharge after expansion. The condensation of this steam takes place in a receiver containing a number of small tubes previously filled with ether. This liquid, owing to its avidity for caloric, robs the discharged steam of its heat, and is vaporised at a pressure depending upon the temperature and volume of the discharged steam. The other engine, identical with the former as to its diameter and the motion of its piston, works under the influence of its ether vapour; it receives this vapour during a portion of its action, and discharges it after expansion into a receiver, similar to the former, kept constantly at a very low temperature by a continual injection of cold-water. Taking care to adapt to each engine a proper expanding apparatus, we are enabled to regulate, at will, the introduction and the expansion of vapour in each cylinder, and thus combine these two elements of power: expansion and volume of steam for the former, and expansion and volume of ether vapour for the latter, so as to arrive at a total maximum force with the smallest expenditure of steam, or, which is nearly the same thing, with the smallest expenditure of fuel. The working of the two engines was satisfactory, and the apparatus fit to be employed without any alteration whatever in its construction. Having once ascertained the certainty of its ability to work in perfect security, we have endeavoured to ascertain the force developed under the three following cases:—First, of a steam engine working alone; Second, engines coupled, the one put in motion by the expansion and condensation of steam, and the other likewise by the expansion and condensation of ether; Third, of an engine working alone by expansion and condensation of ether.

"FORCE PRODUCED.—The index was placed over the cylinders during the various experiments; a lever acted constantly on the main axle. The general conclusions we arrived at are as follow:—As regards the force measured upon the piston by means of the index. The diagrams drawn by the ether vapour exhibit always an excess of power over those drawn by the steam. The final pressure of the ether is generally greater than that of the steam, rarely upon a level with it, but never less. The two cylinders being equal, it follows that, when a volume of steam is discharged at a given pressure into the ether-vaporiser, a volume of ether vapour is obtained, at the very least, equal, and of the same pressure. Several times an excess of pressure was gained of 10, 20, and 30 per cent., with an equality of volume. If, then, we consider the combined effects of these engines proportionally to the mean pressure given by the diagrams, we must conclude that, by the employment of ether, a force measured by 100 becomes at least 200, at times 210, 220, 230, with the same expenditure of fuel. This have we verified and evidently exceeded the inferences drawn from the experiments made in 1846 at M. Philippe's, and, consequently, confirmed the favourable conclusions in consideration of which the Council proposed a more decisive trial, to ascertain whether the use of ether doubles the power without adding to the consumption of fuel." Extract made from the diagrams of the index, taken from observation of the arm of the lever, placed so as to measure the power of the two engines coupled together, the lever gave 80, 90, 105, and even 120 kilogrammes, at 40 and 46 strokes, the weight attached to the lever in the experiment being from 38 to 42 kilogrammes. The steam engine, by itself, was unable to lift the weight attached to the lever, being from 38 to 42 kilogrammes; it stopped immediately upon tightening. The ether engine, by itself, lifted it without difficulty, with a load of about 200 kilogrammes and more; that is to say, that a direct and continual injection of steam into the ether-vaporiser, produced upon the ether engine alone the maximum of work given by the lever.

The breaking out of the revolution in France immediately after the conclusion of the experiments, and the unsettled state of the country consequent thereon, put a stop for the time to any further proceedings for bringing the invention into operation; but upon the appointment of Mons. Arago, the celebrated philosopher, to the Presidency of the Board of Public Works the subject was again taken up, and some improvements were suggested by Mons. Arago himself, who took considerable interest in the subject of the invention, and amongst others he suggested the substitution of chloroform, which is perfectly incombustible and inexplosive, in lieu of ether, which is well known to be highly inflammable. The continued unsettled state of the country, however, has up to the present time prevented further progress being made by the French Government towards carrying out the invention. One most important feature in this invention is not noticed in any way in the report of the French Commissioners. We allude to the power of the vacuum caused by the process adopted in this invention for condensing the steam. It is well known that in ordinary condensing engines a trifling additional power is obtained by means of the vacuum caused by the condensation of the steam, but in this engine, in consequence of the extremely simple, and at the same time perfect, method employed for the condensation of the steam, the power so obtained becomes one of considerable importance. The engine we examined at work at the Messrs. Horne's had gauges fitted to the several parts, showing first the pressure of the steam at its entrance into the first cylinder; second, the power of the vacuum caused by the condensation of the exhaust steam; third, the pressure of the vapour of the perchloride at its entrance into the second cylinder, and fourth, the power of the vacuum caused by the condensation of the perchloride vapour. During the working of the engine we examined minutely the several gauges, in order to ascertain with certainty the average relative power exerted by the four several forces as applied in the working of the engines. The average pressure of the steam in the steam cylinder (the piston making 46 strokes per minute) was only 5 lbs. per square inch; whilst the gauge indicating the power of the vacuum caused by the condensation of the steam, and acting in conjunction with the steam upon the steam piston gave a power of 10 lbs.—making together a total motive power acting upon the steam piston of 15 lbs. per square inch. The power exerted by the expansion of the chloroform vapour upon the piston in the second or perchloride cylinder (which is generated simply by the process of condensing the steam without any additional fuel, was 21 lbs., and the vacuum caused by the condensation of the perchloride vapour, and acting in conjunction with the vapour upon the piston in the second cylinder 8 lbs.; thus giving a total power of 15 lbs. effective in the steam cylinder, and of 29 ditto on the vapour cylinder, giving an average force of 22 lbs. per square inch, with no greater consumption of fuel than is required in an ordinary steam engine to generate a force of 5 lbs. only. In this engine no waste of caloric or, which is the same thing, of fuel, occurs as the steam after converting the perchloride into vapour is returned into the boiler at a temperature of about 136 degrees to 140 degrees Fahrenheit, and the perchloride after condensation is in like manner returned into the vaporiser at a proportionate temperature.

We never witnessed an engine work more easily or steadily, and we strongly recommend it to the notice of all engineers and persons having occasion for the use of steam power, but more particularly to steam-boat companies, as well worthy of attention. We understand a company has been formed in France, and that another is in course of formation in this country, so as to bring the invention before the public, the company having obtained from the inventor, the right to the sole use of the invention in the United Kingdom and the Colonies.

The Ministry of the Marine having caused to be constructed, for the use of the Navy, by M. Charles Beslay, an engine, to which ether, in the first instance, and then chloroform, might be applied as the motive-power, it has lately been tried before a commission, composed of scientific men, and found to be, in a mechanical point of view, perfectly efficient; but, before bringing it into general use, it was necessary to ascertain that the emanation from the use of the chloroform on board ship will not be injurious to the health of the crew. To this end, an experiment was made on Monday, under the direction of Lieutenant Lafont, of the Navy, and in the presence of M. Quoy, Inspector-General of the Medical Branch of the Marine Service, and, in the result, the operation appeared to be conclusively favourable.—Paris paper.

